of these varieties of grants, so far as Government is concerned, amounts, according to the Parliamentary Estimates, to not less than £20,000 a year. It is difficult to estimate how much local effort contributes, how much municipalities give out of local rates, how much private individuals give, &c. But putting aside great donations of tens, twenties, and thirties of thousands of pounds, towards building schools of science and art, technical schools, and provincial Museums, something like £40,000 a year are contributed by local effort, to meet which the yearly Government grant of probably £20,000 is made. It seems unlikely, but we shall gladly accept correction if we are wrong, that the Commissioners can allot more than £4000 a year for Scholarships and grants to provincial institutions. The beneficial and judicious administration of this £4000 would probably cost almost as much as if it were £20,000 a year. Have the Commissioners funds to pay for such administration? Apparently they have not. Will they therefore ask Government to administer their proposed grants? Government has certainly hitherto rather rebuffed advances of help made by the Commissioners, so that we confess to not at present perceiving how the Commissioners can successfully carry out proposals which seem to be beset with dilemmas.

On the other hand, if the Commissioners offer their aid to the country for its unconditional acceptance, it seems to us that they may be open to the charge of weakening local effort, and thus of decreasing the means of extending the influence of science and art upon productive industry. They realized, in 1852, that the subdivision of their means amongst local institutions would be productive of comparatively insignificant effects. A subdivision of smaller means, now that a new condition has arisen, does not under present circumstances appear to give better promise. The sacrifice of part of their estate, and the temporary disarrangement of a section of the national institutions upon it, are hardly warranted by what, at present, seems to be a scheme *in embryo*, the full development of which is not, in truth, forecast.

Without more precise information, therefore, we are rather driven to conclude that an effective and beneficial scheme of Scholarships and grants in aid of provincial institutions is beyond the reach of the Commissioners.

Under the presidency of the Prince Consort, the Commissioners took pains to collect a mass of information in regard to what had already "been done by the public in this country to promote the interests of science and the arts, and the diffusion of scientific principles amongst those engaged in their practical application." Thirty-six years ago they placed on record the evidence which led them to the opinion "that much zeal has been shown in this respect." If they would pause now, they might very well and usefully do again what they did thirty-six years ago—direct their inquiries particularly to the new developments and results of this zeal as demonstrated by its present co-operation with State aid. The result of such inquiries could but prove of high value to the Commissioners, and might, we venture to think, lead them to the conclusion that their present proposals are half a century too late, whilst the preservation of their estate, with its national institutions, including those already existing and those likely to exist. is really abreast of the serious wants of the time.

THE CYSTIDEA OF BOHEMIA.

Système Silurien du Centre de la Bohême. 1ère Partie, Recherches Paléontologiques. Continuation éditée par le Musée Bohême. Vol. VII. *Classe des Echinodermes. Ordre des Cystidées.* Ouvrage posthume de feu Joachim Barrande, publié par le Docteur W. Waagen. Pp. i.-xvii., 1-233; Plates I.-XXXIX. (Prague, 1887.)

TO few is it given to accomplish the life-work that they have planned. Joachim Barrande, vast though his self-ordained task was, came nearer to his goal than do most men. Before the death of the venerable author in 1883, he had made some way with the last volume of the colossal "Système Silurien du Centre de la Bohême." The present work was destined to form the first section of Volume VII., "Echinodermes du Système Silurien." The plates were ready, the general portion of the work written and partly printed, and, on his death-bed, Barrande was still tracing out the descriptions of genera and species. The book has been completed by Dr. W. Waagen, who was appointed, in Barrande's will, editor of this volume. His admirable preface is rendered of practical value by the insertion of a complete list of Barrande's writings from 1846 to 1881.

The work itself is on the plan and in the style already familiar to us. It opens with an historical and critical account of the literature dealing with the Cystidea of the thirteen Silurian regions of the world. The term Silurian is, of course, used in the broadest possible sense. Even Sardinia, as one of these regions, has a section to itself, though the cystids of Sardinia have had less written about them than the snakes of Ireland. This retrospect brings us to 1883; the few observations published between that year and the end of 1887 do not affect the present work.

The second chapter is devoted to the morphology of the Cystidea, chiefly as exemplified in the Bohemian fossils. The arms especially are discussed at great length, and several tables show their presence or absence in the various species as yet known to science.

Then follow the detailed descriptions of the genera and species of Bohemian cystids. No classification is followed. On p. 49 a classification is indeed proposed, according to the number of major openings in the calyx. This arrangement, however, is impracticable, and apparently unnatural. Its chief merit is its simplicity; and yet, as the author naïvely complains, it is not so incomparably simple as the attempt of a certain English palæontologist to classify Silurian cephalopods according to their curvature. The order of description is therefore alphabetical, the only divisions being those of the three faunas. Such an arrangement, however, by no means does away with the necessity for an index, and the absence of that indispensable aid to the practical worker is the one great fault that we have to find with the work. At the present time some 240 species of Cystidea are known, and these belong to about 70 genera. The Bohemian species number 78, two varieties worthy of a name, and one or two indeterminable fragments. Of these species, 76 are here described for the first time, and the majority of them belong to new genera, of which 23 are here established. There are also represented the genera *Agele-*

crinus of Vanuxem, *Atelecystis* of Billings, *Echinosphaera* of Wahlenberg, *Lichenoides*, *Trochocystis*, and *Rhombifera* of Barrande, the latter formerly referred by him to the Pteropoda; and, lastly, the undefined *Cystidea*, which is reserved for the reception of eight or nine doubtful forms, some of which may, at a future date, form the types of yet more genera. It should also be noted that one species —*Echinosphaerites infaustus*, Barr.—has been taken by Prof. Neumayr as the type of his genus *Arachnocystis*. The same authority refers the somewhat doubtful *Rhombifera mira* to *Stephanocrinus*, and points out that *Staurosoma* is the same as *Tiaracrinus* of Schultze.

The genera of this group have been peculiarly unfortunate in the names attached to them. It is no longer necessary for palæontologists to cumber their generic names with the termination *ites*. This peculiar corruption of λίθος seems to set a stigma on fossils, as though they never had been living beings after all. The neontologist is ready enough to throw stones at the palæontologist; there is no need for the latter to supply him with ammunition. Prof. Lovén dropped this affix when editing the Cystidea in Angelin's "Iconographia Crinoideorum," and surely the names are long enough without it. Of far more importance is the correct use of the terminations *cystis*, *crinus*, *blastus*, and the like. We extend indulgence to certain old authors who gave such names as *Agelecrinus* and *Cryptocrinus* to cystids before the Cystidea were distinguished as a class; but when once the divisions were recognized, we must suppose that the eminent palæontologists who used these terminations attached to them some meaning. Even in 1843 we find Messrs. Austin suggesting that the names *Sycocrinites*, Austin, and *Echinocrinus*, Agassiz, "require amendment, as their terminations imply affinities which do not exist." *Apiocystis* means a pear-shaped *Cystid*, just as *Apiocrinus* means a pear-shaped *Crinoid*: the two terminations are *not* interchangeable. Posterity, for whom we labour, will lament that we had not the strength of mind to correct such names whenever we saw them to be misleading; but we ourselves should surely blame most severely those who still add to our perplexity. Why, for instance, should Prof. von Koenen give the names *Corylocrinus* and *Juglandocrinus* to two genera which he himself describes as Cystidea? In no other branch of science would such a use of language to conceal thought be tolerated. The present work we are glad to find free from such flagrant absurdities. The errors of nomenclature are slight: the name *Atelecystis*, Billings, the validity of which was upheld by Dr. H. Woodward, is, though not consistently, supplanted by its synonym *Anomalocystis*; there is also a want of consistency in writing *Pyrocystites pirum*. No attempt, however, has been made to revise the nomenclature of cystids foreign to Bohemia, in which direction much will some day have to be done.

Chapters iv. and v. are devoted to the geological and geographical distribution of Cystidea in general and of Bohemian cystids in particular. Chapter vi. describes the variations seen in the Bohemian species. The seventh and last chapter discusses the connection of these species with those of other countries. These questions are worked out, from a statistical if not from a philosophical point of view, in a large series of tables; a few graphic curve-diagrams would have been a more helpful guide through the wilderness of figures. The numbers of the species found in the various beds of Bohemia are:—

c.	*d*1.	*d*2.	*d*3.	*d*4.	*d*5.	*e*1.	*e*2.	*f*1.	*f*2.
7	12	12	4	46	2	2	3	0	2

This vertical distribution agrees in its main proportions with that observed in almost all other countries. The chief exceptions are the States of New York and Wisconsin, where a relatively large number of species are found in the Niagara limestone, and England, where seventeen species are recorded from Ordovician beds and nine from the Wenlock limestone: none of the Wenlock genera occur in the corresponding beds of Bohemia. The geographical diffusion of the Cystidea is very slight; the most widely distributed genera are *Agelecrinus*, *Atelecystis*, and *Echinosphaera*.

These elaborate comparisons and tabulations are, however, a little bit out of place in dealing with such a heterogeneous assemblage as the Cystidea. They are not a class, but a collection of puzzles to which we relegate all echinoderms that will go nowhere else. Barrande does indeed attempt a definition (pp. 23-24), but not one character mentioned is common to all Cystidea. What one really looks for in such a monograph as the present are new facts that may throw light either on the connection between individual genera and other classes of the Echinodermata, or on the origin and meaning of the various peculiar organs. Taking as guide the motto of Barrande, *C'est ce que j'ai vu*, we shall enter into no speculations, but shall mention such facts of morphological importance as appear to be new. The state of preservation of the Bohemian Cystidea is exceptionally bad; but it would be hard indeed if so rich an assemblage had not yielded to such an observer some interesting results.

Following the order adopted by Barrande in his second chapter, we begin with the stem. The stem of the Pelmatozoa typically consists of a single series of cylindrical joints with a central perforation. In the earlier crinoids the lumen is comparatively large; in most stalked cystids it is still larger. In *Atelecystis*, *Mitrocystis*, and *Trochocystis*, the proximal part of the stem consists of a double series of alternating plates which are thin and inclose a large hollow. In *Arachnocystis* the whole stem consists of four or five series of alternating plates. In *Dendrocystis* the plates forming the upper part of the stem can only be distinguished by their smaller size from those forming the calyx; below they merge into the normal series of single joints. *Cigara Dusli* is the fanciful name given to a stem entirely composed of small irregular plates, and probably belonging to *Lapillocystis fragilis*. These facts forcibly suggest that the Pelmatozoan stem originated as a mere evagination of the perisome. The curiously elongate *Pilocystis* (Pl. II. Fig. 26) may represent a still earlier stage in its evolution.

The test of Cystidea has usually been regarded as composed of one simple layer of plates. Eichwald, in *Lethæa Rossica*, mentioned an epidermis, but seems in many cases to mean by this nothing more than the outer surface of the plates. Lovén, in his monograph on *Pourtalesia*, seems to assume the existence of three elements or layers in the test. Barrande, however, has been the first to conclusively demonstrate that in a number of genera the main layer of the body-plates is closed, both inside and outside, by thin "*épidermes*," which appear to have been partially calcified. *Aristocystis* is the genus affording the most abundant material for the study of these coverings, but they have also been observed in *Arachnocystis*, *Craterina*, *Dendrocystis*, *Neocystis*, *Orocystis*, *Proteocystis*, and *Rhombifera* (*i.e. R. bohemica*): of *Deutocystis* and *Pirocystis*, the inner lining is the only part known. In *Mitrocystis* the great difference between the internal and external impressions (*vide* p. 65) *may* be due to the presence of an inner lining. The outer layer is continuous, and covers up all the pores of the body-plates; sometimes it is even thick enough to conceal their sculpture and the sutures. The inner lining appears to have passed up into the pore-canals, and to have been itself pierced at those points. There is, of course, no reason to suppose that this structure of the test was common to all the forms which we call Cystidea, but the observations of Barrande have undoubtedly opened a new field of investigation.

It has hitherto been usual to classify the Cystidea according to the disposition of their pores. Facts recorded in the present work are opposed to such an arrangement. In the simplest type, canals run right through the inner lining and the principal layer of the test, usually in a curved course: we may call these "haplopores"; they are best seen in *Aristocystis bohemica*. In other species of *Aristocystis*, *e.g. A. subcylindrica* and *A. grandiscutum*, the distal ends of two adjacent haplopores are often connected by a horseshoe-shaped groove on the surface of the middle layer. In the allied *Craterina* this groove appears to have expanded into an oval depression into which open the two canals. This, the familiar diplopore, is also seen in *Proteocystis*. In all these forms the pores do not open to the exterior, but are closed by the outer layer: the horseshoe groove and the oval depression are therefore nothing more than closed horizontal canals connecting the vertical canals; in these genera, at all events, the canals can have had nothing to do with tube feet. The structure of the hydrospire elements in such forms as *Echinosphaera*, *Arachnocystis*, *Caryocystis*, is essentially the same; that is to say, two vertical canals connected by a closed horizontal canal: the only difference is that the two vertical canals are separated by a suture line instead of being on the same plate. From a position originally just beneath the outer layer these horizontal canals seem to have sunk into the main layer of the test, and in *Caryocrinus* they are actually internal. *Rhombifera* (*sc. bohemica*) and *Homocystis* show the gradual specialization of certain portions of the test as canal-bearers: here it seems that the horizontal canals become more developed in proportion; in fact, they appear eventually to assume the whole function, whatever it may be. In such forms as *Lepadocrinus* they alone remain, and here they no longer connect the adjacent plates, but are transformed into two separate sets of folds. As to the function of these organs, Barrande regards it as respiratory, but drops the term *hydrospire*, for the quaint reason that they show no *spiral* structure. Instead, he calls them *hydrophores*. But he also applies this term to certain organs which can hardly be homologous with pore-rhombs. Around an opening, the interior of the calyx appears divided into five compartments; from the opening there passes into each compartment a branch, which subdivides into five or six smaller branches, and each of these ends in a double tubercle. It is impossible to see whether these branches were hollow tubes or no; they have no connection with the exterior, except at the central opening. These *hydrophores palmées* occur in *Aristocystis*, *Pirocystis*, and *Craterina*, forms already abundantly provided with canals: though simulating the hydrospires of Blastoidea as seen in section, they have an exactly contrary position. Neumayr thinks that the opening which they surround is the mouth, and that they are subtegminal ambulacral grooves. How this can be, when their distal ends are unconnected with the exterior, is not easy to understand. Barrande, moreover, cannot say whether they are at the oral or aboral pole. A comparison of Figs. 28 and 32 on Pl. XXIX. suggests that they are at the aboral end, and that the large opening represents the axial canal of the stem. May they not be connected with nerve-cords passing from a chambered organ?

As regards the major openings of the Cystidean calyx, the accepted views are confirmed by Barrande. Somewhat unaccountably, however, he speaks of the anus of *Agelecrinus* as the mouth (p. 84); perhaps he intended to quote Vanuxem, in which case the oversight is the editor's. In addition to the mouth, anus, and genital pore, Barrande describes for *Aristocystis* a slit-like aperture close to the mouth. This he regards as an organ hitherto unknown. At the same time he points out that its position is similar to that occupied by the peculiar folded structure described by Volborth in *Sphaeronis Leuchtenbergi*. More closely still does it resemble the "reniform groove," or "semilunar pore," figured by Forbes in the fossils which he called *Apiocystis* and *Echinoëncrinus*. We notice that *Atelecystis* is still quoted as having anal and genital openings, although neither in this genus nor in its near relation *Mitrocystis* do the Bohemian species show them. The fact is that even in *A. forbesianus* they have never really been found; the appearances described are only accidental. The true openings in all the Anomalocystidae must be looked for in the neighbourhood of the arms.

Although Barrande enters very largely into the question of the arms, he has brought out no results of importance. The arms of *Arachnocystis infausta* are perhaps more developed than those of any other cystid: it is curious how closely they resemble the stem in structure; one would almost imagine that they had originated in the same manner. A similar structure is observable in the process of *Dendrocystis* which Barrande regards as a ventral tube: there is, however, no reason to call it anything but an arm; and at the same time we may remember that the ventral tube of *Poteriocrinus*, to which Barrande and Trautschold have compared it, is not improbably itself derived from an arm.

Such are the points of greatest morphological interest in this fascinating work. Many peculiar and wonderful forms, such as *Acanthocystis*, *Trochocystis*, *Neocystis*, *Mespilocystis*, *Ascocystis*, and *Cystidea nugatula*, must be passed by with mere mention. The question of classification we have left where Barrande preferred to place it—on the shelf. Systematists may even wish that many a one of these new forms had been left in the earth—*irrepertum et sic melius situm*—and not dug up to disturb existing arrangements. We would not, however, seem ungrateful; rather let us hope that the future parts of this volume, though deprived of the care of the great palæontologist, may be equally fruitful of new and interesting facts, and that, in the hands of Dr. Waagen, they may, no less than this one, add still fresh lustre to the name of Barrande.

TEXT-BOOK OF PATHOLOGY.

Text-book of Pathology. By Prof. D. J. Hamilton. Pp. 719. (London: Macmillan and Co., 1889.)

ABROAD, it is usual for a pathologist to devote his whole life and energy to one subject, and to pay little or no attention to the clinical side of disease, concentrating all his attention on the anatomical and histological aspect. This system has both its advantages and its defects. As his future success in life depends solely upon his reputation as a pathologist, he is stimulated to write frequently and much; and one practical outcome is a large number of books, in both German and French, on pathology. These are of very varying excellence, some being mere compilations of the current standard works, while a few represent the results of a mature experience. For naked-eye pathology, English students have an unequalled work in Wilks and Moxon's "Pathology," of which a third edition has recently appeared. Morbid histology is a science of comparatively recent date, and English authors have hitherto confined themselves to writing short manuals for students, which have been supplemented by translations of the more elaborate foreign works.

This "Pathology" is the first English book which has attempted, in its completeness, to compete with the larger Continental works, and as it is the outcome of several years' experience, of one who is already well known for the original work he has published on many of the questions, it will meet with a hearty welcome. The author takes a very wide view of pathology, and includes under this term morbid anatomy, pathological histology, physics, chemistry, and comparative pathology. Theoretically, this is undoubtedly right; but it is extremely inconvenient, when a book is overweighted by collateral subjects; and we think the author would be well advised in a future edition, to omit the chapters on bacteriology and on the experiments which he conducted to illustrate the circulation of the blood. The greater portion of the information on bacteriology is of necessity a repetition of what is given in any text-book on the subject, and is therefore superfluous, except for the purpose of making the book theoretically complete. The experiments on the circulation should be relegated to a book on physiology.

The book commences with a very full account of the method of making a *sectio cadaveri*, with which we would in the main agree. Our experience, however, is entirely opposed to the separation of the heart from the lungs in the body, as he directs. We believe much more may, in a difficult case, be made out if the lungs and heart be removed, and examined together, the amount of blood in the various cavities of the heart having been previously noted.

One of the most valuable portions of the book is that which deals with the preparation of specimens for the museum and for microscopical examination. For the preservation of intestines and other delicate tissues as jar-specimens in a museum, the author recommends a saturated solution of boracic acid; and for eyes, brain, &c., glycerine jelly. Full details are given for the preparation of large sections of the brain by the gelatine-potash method devised by the author, by which he has been able to uniformly expand the sections, so as to more readily show the course of the various bundles of fibres.

The middle third of the book is occupied by a discussion of general pathological processes. The phenomena of inflammation are very fully discussed, and the author gives a good *résumé* of the views now held on the subject, and also of his own conclusions. He considers the blood-pressure to be the cause of the extrusion of the corpuscles which occurs in inflammation. In discussing the phenomena of inflammation of the cornea, he concludes that at first there is an influx into the cornea, which distends the canals and breaks up the endothelial plates; as a consequence, the so-called branching cells of the cornea, which were really the liquid in the plasma spaces, disappear; at the same time the nuclei of the endothelial plates proliferate. The fusiform nuclei which used to be looked upon as the nuclei of the branching cells, he considers to be the nuclei of the fibrous bundles, and as these run in laminæ of parallel bundles, which lie at right angles to those of the adjacent laminæ, the so-called spear-head bodies are formed by their proliferation. The pus comes both from the connective tissue corpuscles and from leucocytes. In granulation tissue, the author holds that the capillary vessels are mainly old capillary loops from the subjacent tissue, which have been pushed up by the pressure of the blood inside them, when the tense surface of epithelium has been destroyed; and he draws attention to the absence of granulations in a wound on the pleura or peritoneum where the surface pressure is still kept up, and considers that the vessels found, when the pores of a piece of sponge applied to a wound become vascularized, are at first not new vessels, but those of the tissue which have pushed up into the pores.

The third part deals with the diseases of the various organs and tissues. Some interesting facts are given as to the means by which tubercle may be spread:—

(*a*) By inoculation. When the poison is introduced subcutaneously, the disease is reproduced with great certainty. It is remarkable, however, how rarely the disease is contracted through superficial scratches by pathologists; for, although tubercle bacilli have been found in *post-mortem* sores, the author thinks no one has become tubercular in consequence; but this is too sweeping a statement.

(*b*) Through ingesta. Rabbits and guinea-pigs readily become tubercular when fed upon tubercular tissues or sputum, while dogs are less readily infected. Herterich has recorded the case of a healthy widow with two children, who married a second husband who had phthisis, by whom she had three children. She herself became phthisical, and her two youngest children developed deep yellow-coloured ulcers on the mouth and fauces, and ultimately general tuberculosis. The children had been fed on food which the mother had previously chewed. Reich records ten cases of tubercular meningitis in a country village, occur-